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Fifteen children from each of three kindergarten classes were randomly chosen to participate in this study and were randomly assigned to one of three treatment groups: (1) a group that received a perceptual training program; (2) a group that received augmented attention but no program; and (3) a control group that received no special program nor attention. The program and attention sessions occurred once a week for 25 minutes. The purpose of this study was to discover if kindergarten can facilitate later reading skill development and, specifically, if a perceptual training program increases the likelihood that children will succeed in learning to read. All the children in the study were pretested on a perceptual motor development test and posttested on a reading readiness test. The study ran from September 1967 to May 1968. Children in group one scored higher than those in group two, who, in turn, scored higher than children in the control group. These differences, however, were not significant. Also, although chronological age was not found to correlate with reading readiness scores, the scores on the perceptual motor development test did correlate with the readiness scores. No performance differences were attributed to variations in teaching style or classroom. (WD)

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Final Report

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Effect of a Kindergarten Program of Perceptual Training Upon the Later Development of Reading Skills

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Summary

In recent years all phases of our educational system have come under continuing scrutiny and review. This study attempted a somewhat closer view of one aspect of American education, the kindergarten program.

In a review of the literature, it is noted that some critics contend the entire kindergarten program is wasteful effort and imply it might well be dropped. A second group contends that kindergarten programs as currently developed have real value and should be continued. A third group posits that, while the kindergarten experience has intrinsic worth, curriculum, methodology, and other variables should be systematically studied if we are to derive maximum benefit from the kindergarten experience.

This study represents an effort in this last category. Specifically, we were interested in seeing if a particular curriculum, a program of training which it was hoped would sharpen perception and sensory awareness, would have an effect on first-grade reading skills.

A second variable considered is the possible effect of contact with teacher upon later development of reading skills. The hypothesis here is an interpersonal one--that the more contact the kindergarten youngster has with teaching staff, the greater will be his academic achievements and that this process is relatively independent of specifics in the kindergarten curriculum.

Another set of variables, running at 90 degrees to the two questions raised above, has to do with the effect of a configuration of teacher personality and curriculum upon final result, that is, reading readiness. Since the children studied come from different classrooms, it is possible to sort out any difference which might be attributable to their original classroom placement. If differences are found, it is possible to post hoc make some inferences regarding cause.

Another, and perhaps overriding, consideration is the effect of development and maturation per se. Basically, this hypothesis is that reading readiness is a function of maturation and that like walking and the many other skills studied by Gesell et al. will spring forth at its proper, albeit individual, time.

In this study, children from three classrooms were assigned to either (a) a program of training to encourage perceptual development, (b) a program of augmented individual attention, or (c) a control group. The developmental hypothesis was studied by looking for a realtionship between

our preliminary test of development and our final test of reading readiness. The hypothesis would be borne out to the extent to which there is a large measure of relationship between these two scores, which relationship is uninfluenced by any treatment method or other environmental consideration.

Cursory inspection of the obtained results shows differences in the expected direction. The mean scores for children in the perceptual training group is greater than the average score obtained for children in the augmented attention group, which in turn is slightly higher than the mean score for children in the control group. A statistical test of the meaningfulness of this difference is, however, not significant. Turning to differences in reading readiness scores which might be attributable to different teaching techniques or classroom atmospheres, we find our scores to be virtually identical. Because of differences in initial ability, which differences are attributable to the random selection of children for the project, it seems as though children from two classroom settings showed more gain than children from the third classroom. A statistical test, however, does not show this difference to be statistically significant.

The maturational hypothesis, on the other hand, produces results which are highly significant statistically. Although chronological age does not correlate with scores on the reading readiness test, the test of perceptual motor development is very predictive of success on the reading readiness test. A t score for the significance of the obtained regression factor shows p less than .001.

In conclusion, this study suggests that maturation as measured by a perceptual development test, but not as measured by chronological age, is predictive of a high score on a reading readiness test. Whether or not early development of perceptual motor functioning is inherent or genetic or, alternately, whether it reflects early experience and environmental conditions is an open question. Although statistical tests of the effects of our training procedures are not significant, differences are in the expected direction. Considering the brief amount of time devoted to the experimental procedures, one-half hour per week for each child, this difference is provocative and suggests that further study in this area using a more intensive program of perceptual training is warranted. It is also interesting to speculate why children from one classroom who were relatively advanced seemed to show little progress while children from two other classrooms show a greater degree, although again not statistically significant, of progress. Again, further studies in teacher personality and the productiveness of differing curriculum seem indicated.

Introduction

The primary importance of reading in education is, without doubt, so well accepted that it is unnecessary to prove or defend the case for reading's importance in the curriculum. Despite this, there are large numbers of children who come to school from families in which there is little or no preparation, stimulation or interest in reading. In addition, it might well be assumed that these children had little of the basic perceptual and motor training which recent investigations have indicated are basic for the development of reading skills.

At the present time, much interest is being shown in the culturally disadvantaged child. In addition to the low-income deprived child, it seems probable that many children may be culturally disadvantaged in coming from homes lacking opportunity for this basic perceptual training and encouragement, even though these families may have adequate or considerably greater-than-average income.

There is also considerable controversy regarding the importance and functioning of the kindergarten system. For example, Spodek and Robinson (1965) conclude that significant programs can be offered in kindergarten which would include "meaningful experiences and include free manipulative and dramatic forms of play." Reading and symbol readiness could be taught. They stress also the value of the kindergarten program to emotional expression and social adjustment.

Other critics and investigators are less positive. There are complaints of the bordeom of children who are repeating essentially a nursery school program and presumably developing a negative attitude toward school--they expected to learn, not just play when they entered school. These critics contend that the kindergarten, rather than heighten, tends to retard the social development, creativity, and independence of many youngsters.

Along this critical line, Fox and Powell (1964) note that "advocates of kindergarten education . . . believe that experiences such as getting meaning from pictures, learning to discriminate between likenesses and differences, remembering a sequence of ideas, learning left and right, practicing auditory discrimination, and using number concepts are essential in the development of readiness for learning basic skills in the primary grades" (p. 119).

Fox and Powell presented the Lee-Clarke Reading Readiness Test to two groups of children, one of whom had a kindergarten experience and another who had not. They found no significant difference in reading readiness in their two groups and concluded that the hypothesis that kindergarten

experience develops readiness must be rejected.

To further test for difference in learning they also presented, to these same two groups of children, the California Achievement Test in Reading at the beginning of the second grade, and again found no difference in achievement between the two groups.

Turning to the question of why some children have greater success in learning to read in the primary grades than others, we find a mass of theories and hypotheses, most of which offer some meaningful explanation and, at times, some suggestions for improving the teaching of reading. There is certainly yet no final explanation, much less any panacea which the frustrated primary teacher can use to improve the reading abilities of the students who are not successfully mastering this skill.

The relationship of intelligence and intellectual development was possibly the first approach to an attempt to understand the process of learning to read. The answers have, however, been less than satisfactory. Not only does much controversy remain about the nature of intelligence, but there is also serious question about the techniques used to measure intelligence and whether these techniques discriminate against the culturally disadvantaged. (For example, see American Psychologist, 1965, Vol. 20, November, entire issue.) Intelligence as a factor in reading does not explain why many children of known normal or above intellectual development have reading disabilities.

Many investigators have explored the influence of cerebral dominance (Coleman & Deutsch, 1964; Delacato, 1959). Coleman and Deutsch note that "mixed and crossed lateral dominance and poor right-left discrimination have long been implicated in disorders of reading. The failure of children to establish complete unilateral preferential usage has been seen as an expression of incomplete cerebral dominance, or as an expression of a neural maturational lag underlying reading disability. Others consider the possible interference of incomplete lateral dominance with the development of right-left discrimination, which itself is considered essential to learning to read. Belmont and Birch (1963) note, however, that these factors are not always found in the population of retarded readers. In their experiments, they found that mixed dominance does not differentiate between normal and retarded readers. Their studies were, however, done with somewhat older children. Along this same line, they found much mixed dominance for handedness in children until the age of nine and, "in considering correspondence between eye and hand usage, we found that a chronological age of 10 was model for the normal establishment of ipsilaterality. Prior to this age, less than half of the children exhibited consistent

ipsilateral hand-eye usage" (p. 268). They note also, "On the basis of our data on bright normal children from a middle-class background, the age of seven appears to be critical for the development of the ability to distinguish left and right in relation to one's own body parts . . . . When the demand was shifted from own body parts to objects in the external environment, fully accurate right-left awareness was not stabilized in ages below the 11-year group" (p. 268). They conclude, "The implications that have been drawn between the development of hand preference and reading disability must be re-assessed . . . . It is far more likely that developmental lag in lateralization and evidence of reading disability are independent manifestations of a more general underlying disturbance in neurological organization and are not etiologically related to one another. A similar line of reasoning can be applied to those studies in which lag in the establishment of lateral dominance have been related to emotional and personality disorders" (p. 269).

Another approach has been to study the relationship between perceptual development, as a more or less independent variable, and reading skill. It is clear that reading requires an integrate series of perceptual and motor processes. The exact nature of these processes and their development is still being studied. For example, Birch and Belmont (1964) studied a group of children with normal or corrected vision and normal hearing, drawn from a suburban elementary school for intellectually normal children. Their perceptual task involved the child's ability to match an auditory tap pattern with a visual stimulus representation of the pattern. They found that the ability to make this integration is more important than IQ in acquiring reading skills. However, for later development of further reading ability, general intelligence becomes more important than the perceptual integration skill.

Among some other studies relating perceptual process and reading, Knoblock (1965) studied some correlates of perceptual maturity as revealed by the Rorschach and reading facility. He found that when IQ scores are held constant the good readers "demonstrated a perceptual approach which could be categorized as genetically superior to that of poor readers" (p. 279). Similarly, Ames and Walker (1964) found that the Rorschach does predict success when IQ is held constant. The Rorschach signs are mainly in the cognitive rather than in the emotional areas.

That good reading may involve perceptual integration of more than visual stimuli has been noted above in Belmont and Birch's study involving auditory and visual integration. This viewpoint is further elaborated by Birch (1962) who postulates a developmental sequence of levels beginning with

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perceptual discrimination, a later level of perceptual analysis, and finally a level of perceptual synthesis. He comments on the results of organic brain damage in blocking the development of this sequence. Question can also be raised as to whether or not experiential factors are necessary to the orderly progression of the perceptual skills necessary for reading. At any rate, Christine and Christine (1964) found there is a difference in auditory discrimination between good and poor readers, but no relationship between functional articulatory speech disorders and reading. Wepman (1962) notes that auditory perception develops differently in various children without necessary pathology or mental deficiency. He goes on to note that there may be many causes to dyslexia, one of which may be inadequate development of auditory perception. In one of his studies, for example, "27% of 80 children in the first grade showed inadequate auditory discrimination and reading scores significantly below the reading level of the children with adequate auditory discrimination." Intelligence, of course, was held constant.

Another perceptual area which has been studied by numerous investigators which is more obviously experiential in *nature--that is the ability to perceive in an orderly fashion.* Chinese is read from top to bottom, Hebrew from right to left, and English from left to right. Right-left reversals in English are commonly found even in normal beginning readers, as all primary teachers will testify. Gottschalk, Bryden, and Rabinovitch (1964) note that, "the acquisition of the ability to respond in a systematic fashion is probably of major importance in later learning to read" (p. 815). They find gradual change in perception from hit-and-miss to a more stable pattern is normally determined by maturational and general experiential factors. Further studies on the importance of directional sense are reviewed by Benton (1962). He concludes that these factors "may play a significant role in the early school years . . . but it does not seem that they can be made to account for more than a small proportion of the cases of severe dyslexia presented by older school children" (p. 101).

A rather elaborate theory of perceptual development, a test of development of visual perception, and a training program for visual perception has been developed by Frostig (1963) in collaboration with several other workers. They examine and train for perceptual development in five areas: (1) eye-motor coordination, (2) figure-ground relationships, (3) shape consistency, (4) position in space, and (5) spacial relationships. Their test has had fairly extensive standardization and a high degree of reliability. Validity has been measured against such variables as classroom adjustment ($r = .441$), motor coordination ($r = .502$), and intellectual functioning ($r = .497$). They report also considerable

accuracy in use of the tests to predict reading in preschool children and success for their method of training in perceptual development for the acquisition of skill in reading.

Recently there has been much awareness of a distinct syndrome called "hyperkinetic disorder" or minimal brain damage, (Strauss & Lahtinen, 1947; Laufer, Denhoff, & Solomons, 1957) which interferes with these youngsters' ability to receive or screen out perceptual material. Specific educational techniques which include much concrete handling of perceptual material and screening of extraneous material have been developed. There is one suggestion that similar techniques may be advantageously used with emotionally disturbed children, at least, who have no diagnosable organic signs (Talmadge, Davids, & Laufer, 1963). In this proposed study, two extensions are suggested: (1) to utilize as training aids perceptual material which is not symbolic in nature and (2) to ascertain if the training techniques are useful to an average group of school children.

It is hoped that this summary has outlined two basic and related areas of concern. (1) How can the kindergarten experience be made more meaningful for the later development of reading skills? (2) Can a program of training for perceptual development increase the likelihood that the youngster will succeed in learning to read? This second question has, of course, many related theoretical implications for the theory of reading. Our hypothesis is that children who are exposed to a systematic training program for perceptual development will have greater success in reading at the first grade level than children who are exposed to the more conventional kindergarten program. Our concern here is not with pathology but with a technique for enhancing the likelihood of success in learning reading in the first grade.

That this is more than an isolated, occasional problem can be seen in reviewing the results of the reading readiness testing program in the first grade of the Manteca schools. It seems reasonable to assume that these findings are representative of children entered in the first grade in most school systems.

Using the McHugh-McParland Reading Readiness Test, with a total enrollment of 588 first graders, 250 or 43% achieved scores of less than 51, indicating they are not ready for reading instruction. Two hundred and seventy-six children or 47% scored between 51 and 75, suggesting they will require limited reading programs and help, and only 62 (or approximately 10%) scored above 76, indicating readiness and a good prognosis for success in a typical reading training program.

Method

Fifteen children were chosen at random from the class roles of three kindergarten teachers and again randomly assigned to (a) a group to receive a program of perceptual training, (b) a group to receive an equivalent amount of time in experimenter-led play activities, and (c) a control group of children who would participate in the regular school program except for the initial and final performance testing. Thus a three by three factoral design experiment was established which later expedited statistical treatment of the data accumulated.

The forty-five children thus selected were tested during the second week of school in September 1967 with the Frostig Test of Perceptual Development. This testing was done by the writers, in small groups of five or six children. The examiners did not at that time know into which experimental or control group the child would be placed. A summary of the results of that testing is shown in Table I, which shows the means for each subgroup. The mean score obtained by children who had been selected for the two experimental and the control groups is given at the foot of each column. The means for the classroom teachers are at the ends of the rows.

Table I

Mean Raw Scores
Frostig Test of Perceptual Development
Preliminary Testing

N = 5 for Each Cell

Teacher	Perceptual Training	Augmented Attention	Control	Mean for Teacher
1	27.00	30.40	18.20	25.20
2	31.60	28.00	34.20	31.47
3	27.00	28.60	26.60	27.40
				Overall Mean
Mean for Treatment	28.53	29.20	26.33	28.02

It can be seen that children selected for the augmented attention situation achieved a somewhat higher average score than children selected for the perceptual training program, who in turn received a somewhat higher score than children who had been selected for the control group. It is noted also that children selected from the room of teacher #2 achieved higher average scores than children selected from the room of teacher #3, who in turn scored on the average somewhat higher scores than children selected from the room of teacher #1. Initially it was thought these differences might be adjusted through re-assignment. However, a statistical test, using analysis of variance, indicated these to be random samples from a common population; and it was felt that less error would be introduced by utilizing analysis of covariance techniques than by manipulating classroom constellations.

Similarly, analysis of the mean chronological age of children in the various subgroups does not show any statistically significant differences. Mean chronological age, expressed in months, is shown in Table II for the various subgroups and treatment and teacher variables.

Table II

Mean Chronological Age, in Months,
of Children Assigned to Each Group
at Start of Study

Teacher	Perceptual Training	Augmented Attention	Control	Mean for Teacher
1	64.00	65.20	61.00	63.40
2	64.00	64.20	64.40	64.20
3	64.80	61.80	60.40	62.33
				Overall Mean
Mean for Treatment	64.27	63.73	61.93	63.31

Although original intent in planning the project was to include the major experimental variables of perceptual training and an equal amount of augmented attention into the standard curriculum, practical considerations, notably difficulty in planning an experimental curriculum after school was already underway, made this impossible. It thus became necessary to add the training or attention to the school program. Parental permission was obtained for

the children selected to remain at school or come to school early one day each week. Thus our programs of augmented attention and perceptual training were limited to a weekly session for each child of approximately 25 minutes. Children were seen in these sessions in groups of five.

The perceptual training attempted used a wide variety of materials, some original or adapted to the purposes of this project, others were standardized materials designed for the purposes of perceptual training and having fairly wide utilization. A list of materials used and description of some materials developed for this project are included as Appendix A. Except for one session which was led by the principal investigator, all sessions were led by the co-investigator.

Children in the augmented attention groups received a fairly conventional kindergarten type of program. This included story telling, drawing and coloring, and the like. It is recognized there is a certain quantity of training for perceptual development in all these tasks. There was, however, no specifically developed program of perceptual training involved.

The programs as outlined above continued from the third week of school in September through the end of May 1968. Virtually no attrition was found. Only two children from our total N of 45 moved from the district. Fortunately, they were in widely separated subgroup cells, and it was possible to estimate final test scores by a process of extrapolation. This latter procedure was necessitated by limitations in available computer programming to handle the experimental design.

In the week following the last training or attention session, all children were tested with the Lee-Clarke Reading Readiness Test. This testing was done in groups of ten by the principal investigator.

Results

Table III presents the mean scores of the children in the various experimental groups and for the major treatment variables on the Lee-Clarke Reading Readiness Test. The average scores obtained by children in the perceptual training, augmented attention, and control groups are given at the foot of each column; and the average scores obtained by the children from each of the three classroom teachers are shown at the ends of the rows.

Table III

Mean Scores on Lee-Clarke Reading Readiness Test
at Conclusion of Study

N = 5 for Each Cell Except as Shown

Teacher	Perceptual Training	Augmented Attention	Control	Mean for Teacher
1	51.40	47.00*	46.40	48.27
2	50.00	44.60	50.00	48.20
3	50.00	48.60	42.20*	46.93
				Overall Mean
Mean for Treatment	50.47	46.73	46.20	47.80

*One case missing

Cursory inspection indicates that children in the perceptual training group obtained highest scores on the Reading Readiness Test. Next highest scores were given by children in the augmented attention group, and the average scores of children in the control group are a trifle lower. Turning to the scores analyzed according to teachers, we find slight differences. If we refer to Table I, however, the children drawn from the room of teacher #2 were initially more mature in perceptual development. Using the Frostig Test as a baseline, we calculate difference scores of 23.07 for teacher #1, 16.73 for teacher #2, and 20.40 for teacher #3.

In order to test the possible statistical significance of these obtained differences, the data was analyzed on the Model 6400 Computer at the University of California, Berkeley, using an analysis of variance and covariance program developed at the Biomedical Facility, University of California at Los Angeles.

Using the Reading Readiness scores as the independent variable and the Frostig Test and chronological age as covariants, regression coefficients of .643 for the Frostig and .033 for chronological age are found. Computed t values for these coefficients are 4.31 and .09. The probability of the first score being obtained by chance is less than .001. It is thus concluded that the Frostig Test of Perceptual Development given at the beginning of the kindergarten year accurately predicts score on the Reading Readiness Test presented

at the end of the kindergarten year. Chronological age itself, at least for the age range studied, has no predictive value.

Partialing out the effects of treatment on the value of the independent variable, with a total of unity, we find treatment one, perceptual training, to be 2.56; augmented attention, -1.99; and the control group, -0.58. Similarly, for teachers, teacher #1 contributed 2.16; teacher #2, -1.98; and teacher #3, -0.18. Continuing with the analysis of variance, however, we find that the mean squares for either set of experimental variables are not significantly greater than the error mean square; and it cannot be assumed that any of the differences obtained is not due to chance.

Conclusions

An experimental program designed to demonstrate the effectiveness of a program of perceptual training on a measure which predicts reading skills failed to show this, although differences were in the expected direction. Considering the extremely limited amount of time, approximately 25 minutes weekly, devoted to the group training sessions, results are encouraging; and further study using more intensive efforts would seem to be appropriate.

Two other factors which had not been anticipated also emerged. One is an apparent affirmation of the developmental hypothesis. Whether this reflects innate or genetically determined differences in intelligence or early perceptual development is an open question. At any rate, studies of pre-kindergarten perceptual development and possible perception training seem warranted. Secondly, rather marked, although not statistically significant, differences on the Reading Readiness Test may reflect differences due to teacher personality or classroom atmosphere or curriculum or some combination of these variables. Further study of these variables and their effects on reading and attainment of other school skills is suggested.

The obtained results relate perceptual training and other variables to a reading readiness test and not actual skill in reading. It is planned that a follow-up evaluation will be done when the children included in this project have completed the first grade. In this instance, we shall evaluate actual progress in reading as measured by some objective test with our experimental variables. These results will be published later as a follow-up study or research note.

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Appendix A

As indicated in the body of the report, a wide variety of training materials and situations were used. These included:

1. The Frostig Program for Perceptual Motor Development. A variety of materials were selected out from the Frostig Program which in the judgment of the investigators appeared appropriate and meaningful to the children. Much of the Frostig materials seemed to be too simple for the children, and efforts were made to select out items which would have learning value.

2. Perceptual training material distributed by Teaching Resources, an educational service of the New York Times.

3. Sound effects recordings produced by Electra Records.

4. Sounds and Pictures, four volumes, published by Scott Foresman.

5. Porteus Mazes, distributed by Psychological Corporation.

6. A collection of common items--scissors, can opener, thread, light bulb, jackknife, flashlight, candle, walnut, sandpaper, nail, wood screw--which were used for tactile identification.

7. Buzzer boards, a dry cell push button and buzzer assembly with which Morse code-like patterns could be produced. Children repeated sound patterns produced by the experimenter and also produced sound patterns that were presented visually as dots and dashes.

8. Mazes were constructed with sawhorses and boards. Children walked through patterns that had been shown in drawings.

9. Various readily available jigsaw puzzles.

10. Bodily awareness games such as Simple Simon Says and Hokey Pokey, which stress awareness of left-right and body positions.

11. Children made spontaneous recordings and were then asked to identify themselves and others.

12. A Braille writer was used. Children were given practice in finding similar patterns. This device was used for identification both visually and tactilely. In later

series, children were blindfolded for practice in tactile recognition alone; and in later series, the same material was used for practice in memory for the Braille pattern.

Appendix B

A total of 24 training or augmented attention sessions were held. Thus each youngster had a maximum of 12 hours of supplementary work. Attendance, while good, was not perfect. Thus the median number of hours of additional work was somewhat less than this maximum.

Week by week curricula of perceptual training tasks:

Week 1 - Getting acquainted and playing various finger-play games at the kindergarten level.

Week 2 - Jigsaw puzzles.

Week 3 - Bodily awareness games and exercises.

Week 4 - Body mazes.

Week 5 - More complex body mazes.

Week 6 - Tape recorder, common noises, and drawings.

Week 7 - Sound effects records.

Week 8 - Scott Foresman series, "Sounds and Pictures."

Week 9 - Idenfitication of common items hidden in sack.

Week 10 - Porteus Mazes.

Week 11 - Buzzer boards.

Week 12 - Buzzer boards reproducing patterns presented visually.

Week 13 - Frostig Developmental Series, Workbook pp. 4, 6, 7, 8.

Week 14 - Frostig pp. 9, 10, 11, 13, 14.

Week 15 - Frostig pp. 15, 16, 17, 18.

Week 16 - Braille dots, recognition of similarities.

Week 17 - Braille dots, blindfolded, pattern memory.

Week 18 - Buzzer boards, pattern associations with primary colors.

Week 19 - Buzzer boards, sound pattern association to words such as cat, dog, rabbit.

Week 20 - Frostig tasks 20, 21, 22, 23. Visual retention exercises.

Week 21 - Frostig exercises 24, 25, 26.

Week 22, 23, 24 - New York Times Visual Perceptual Teaching Materials presented as per manual. More advanced work in this same series was used for the remainder of the sessions.